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REVIEWS.

VOLCANOES AND EARTHQUAKES.* — Professor Hunt has said more in the ten pages of this little pamphlet than would suffice to fill an ordinary volume. After a description of volcanoes, volcanic products and the various zones, or regions of the earth in which volcanoes are found most abundantly, the author sums up the different theories which have been advanced in the endeavors to account for these phenomena. He rejects entirely, and with crushing force, the theory which attempts to account for volcanoes by supposing that they are the vents of a liquid nucleus, and gives a summary of his reasons for doing so from which we quote the following paragraphs:

"Judging from the known properties of the rocks with which we are acquainted, solidification should commence not at the surface, but at the centre of the liquid globe, a process which would moreover be favored by the influence of pressure. This augments the melting temperature of matters, which, like the rocks and most other solids, become less dense when melted, while on the other hand it reduces the melting point of those which, like ice [or bismuth], become more dense by fusion. Pressure, moreover, it may be mentioned in this connection, increases the solvent power of water for most bodies, whose solution may be described as a kind of melting down with water into a compound whose density is greater than that of the mean of its constituents; the importance of this point will appear farther on. The theory deduced from the above considerations, and adopted by Hopkins and by Scrope, is briefly as follows: the earth's centre is solid, though still retaining nearly the high temperature at which it became solid. At an advanced stage in the solidifying process the remaining envelope of fused matter became viscid, so that the descent from the surface of the heavier particles, cooled by radiation, was prevented, and a crust formed, through which cooling has since gone on very slowly. There were thus left between this crust and the solid nucleus, portions of yet unsolidified matter (or even perhaps, as suggested by Scrope, a continuous sheet), and it is in the existence of this stratum, or of lakes of uncongealed matter, that we are to find an explanation of all the phenomena of volcanoes and earthquakes, of elevation and subsidence, and of the movements which result in the formation of mountain chains, as ingeniously set forth by Mr. Shaler. The slow contraction of the gradually cooling globe, a most important agency in the latter phenomena, is evidently not excluded by this hypothesis. It may be added that a similar structure of the globe, viz., a solid nucleus and a solid crust separated from each other by a liquid stratum, was long ago suggested by Halley in order to explain the phenomena of terrestrial magnetism. Scrope has completed this hypothesis by the suggestion that variations in tension or pressure may cause portions of matter beneath the surface to pass from solid to liquid, or from a liquid to a solid state, and in this way helps us to explain the local and the temporary nature of volcanic activity.

This theory of Hopkins and Scrope apparently so complete in itself, is an approximation to the one which I adopt, though differing from it in some most important particulars. While admitting with them the existence of a solid nucleus and a solid crust, with an interposed stratum of semi-liquid matter, I consider this last to be, not a portion of the yet unsolidified igneous matter, but a layer of material which was once solid, but is now rendered liquid by the intervention of water under the influence of heat and pressure. When, in the process of refrigeration, the globe had reached the point imagined by Hopkins, where a solid crust was formed over the shallow molten layer which covered the solid nucleus, the farther cooling and contraction of this crust would result in irregular movements, breaking it up, and causing the extravasation of the yet liquid portions confined beneath. When at length the reduction of temperature permitted the precipitation of water from the dense primeval atmosphere, the whole cooling and disintegrating mass of broken-up crust, and poured out igneous rock would become exposed to the action of air and water. In this way the solid nucleus of igneous rock became surrounded with a deep layer of disintegrated and water-impregnated material, the ruins of its former envelope, and the chaotic mass from which, under the influence of heat from below and of air and water from above, the world of geologic and of human history was to be evolved.

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* Abstract of a Lecture by Professor T. Sterry Hunt, LL. D., F. R. S., delivered before the American Geographical and Statistical Society, April 22, 1869. Pamph., pp. 10.

It must be borne in mind that water under pressure and at high temperatures, develops extraordinary solvent powers; while from what has already been said of the influence of pressure in favoring solution, it will be seen that the weight of the overlying mass becomes an efficient cause of the liquefaction of the lower portions of the sedimentary material. Time is wanting to discuss the great forces which from early geologic periods have been active in transferring sediments, alternately wasting and building up continents. By the depression of the yielding crust beneath regions of great accumulation there follows a softening of the lower and of the more fusible strata, while the great mass of more silicious rocks becomes cemented into comparative rigidity, and finally, as the result of the earth's contraction, rises a hardened and corrugated mass, from whose irregular erosion results a mountainous region.

Those strata, which from their composition yield under these conditions the most liquid products, are, it is conceived, the source of all plutonic and volcanic rocks. Accompanied by water, and by difficultly coercible gases, they are either extravasated among the fissures which form in the overlying strata, or find their way to the surface. The variations in the composition of lavas and their accompanying gases in different regions, and even from the same vent at different times, are strong confirmations of the truth of this view, to which may be added the fact that all the various types of lava are represented among aqueous sedimentary rocks, which are capable of yielding these lavas by the process of fusion."

GEOLOGY OF COLORADO AND NEW MEXICO.* — With the small appropriation of ten thousand dollars, Dr. Hayden appears to have traversed in one season a very large territory, made extensive collections and a series of valuable and minute observations upon the geological structure of the country. The report of these is accompanied by a report upon "The Mines and Minerals of Colorado," by Professor Frazer, which gives a fair and candid statement of the mineral wealth of Colorado and New Mexico; and by a report upon the Agricultural Resources of Colorado.

These various reports cannot fail of attaining the object for which they were written, since in them every one interested in the future development of these territories may find reliable and unprejudiced information with regard to their natural resources. The sum of money appropriated for this purpose was so small that Dr. Hayden could not have accomplished a large portion of his explorations without their assistance. The appropriation of ten thousand dollars, by the central government, to explore two territories, while a state is spending annually more than twice that amount, per annum, upon a single institution, might excite some surprise and confusion in the minds of a foreigner.

The route lay along the eastern foot of the Rocky Mountains, from Cheyenne, in Wyoming Territory, to Santa Fè, the Middle Park having been explored by a lateral excursion from Denver City. Returning from Sante Fè they returned to Denver by passing up the Rio Grande and crossing the Rocky Mountains through the South Park. The explorer's remarks with regard to the superficial deposits are very interesting, and their general importance as an explanation of the origin of some of the most interesting localities is our justification for the following extract:

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* Preliminary Field Report of the U. S. Geological Survey of Colorado and New Mexico. By Dr. F. V. Hayden. Washington, D. C. 8vo. 1869.